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Examiner : Kevin L. McHenry
Art Unit : 1725
Docket No.: 52433/675

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : T. TAKEUCHI et al.
Serial No. : 10/031,317
Filed : January 16, 2002
For : CERAMIC PLATE FOR SIDE WEIR OF TWIN DRUM TYPE
CONTINUOUS CASTING APPARATUS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE

SIR:

Reconsideration of the above-identified patent application is respectfully requested. This communication is responsive to the Office Action mailed February 19, 2003. A petition for an extension of time in which to respond to the Office Action accompanies this response.

Claims 1-5 are pending in the application.

§103

Claims 1-5 were rejected under 35 U.S.C.
§103(a) as being unpatentable over WO 98/35775 in view of
Japan No. 4-342468.

This rejection is respectfully traversed.

Patentability Of The Present Invention

Invention of Claim 1

Claim 1 (independent claim) is characterized by

(1) containing

(a) Al of 9 mass% or more in terms of Al equivalent, and

(2) having the properties of:

(b) bending strength at room temperature of not less than 120 MPa,

(c) bending strength at 1,000°C of not less than 65 MPa,

(d) hardness (Hv) of 50 to 350,

(e) fracture toughness K_{Ic} at 1,000°C of not less than 1 MPa·m^{1/2},

(f) thermal conductivity at a temperature from room temperature to 1,000°C of not more than 8 W/(m·K),

(g) thermal shock resistance index R' of not less than 800 W/m, and

(h) wettability with molten steel (contact angle θ) of not less than 120°.

Furthermore, claim 1 particularly embodies the features (a), (f) and (h) as follows.

The side dams of a conventional ceramic plate material erode radically at the contacting the portions where the cooling drums and the molten steel contact each other (refer to lines 20 to 33 on page 3 in the description).

That is, the erosion resistance is an important property of a ceramic plate material that is basically required of the side dams.

Therefore, feature (a) is an important feature of claim 1 because the content of Al (9 mass% or more in terms of Al equivalent) ensures the pre-determined erosion resistance in the ceramic plate material for side dams composed mainly of BN, Si_3N_4 and AlN (refer lines 13 to 30 on page 5 in the description and Fig. 1).

As the ceramic material for side dams is required to have excellent basic properties as well as the erosion resistance in order to cope with the formation and deposition of skull that hinder stable operation of continuous casting, "thermal conductivity" and "wettability" are focused on and adopted as important indexes for evaluating and realizing the excellent basic properties of the ceramic plate material of Claim 1 (refer to line 13 on page 4 to line 12 on page 5).

Both the "thermal conductivity" and "wettability" are new indexes characterizing the properties of a ceramic material for side dams because neither of "WO98/35775" (WO775) nor "JP4-342,468" (JP468) disclose or suggest these indexes or any technical matters related to these indexes.

Therefore, both feature (f) and feature (h) of Claim 1 are important features, in addition to the feature (a), embodied by Claim 1 based on the ceramic material

including Al of 9 mass% or more in terms of Al equivalent (feature (a)) (refer to line 31 on page 5 to line 3 on page 6).

As a result, Claim 1 that embodies especially the features (a), (f) and (h) has the significant effect to be able to cast stably and continuously stainless steel having a uniform composition and structure with high production efficiency in continuous casting, even though the amount of casting per one operation increases.

Furthermore, the effect of Claim 1 is not obvious in view of "W0775" and "JP468" because neither "W0775" nor "JP468" disclose or suggest the indexes or any technical matters related to the indexes that are required in Claim 1 for the first time by the inventors of the present invention.

The Prior Art

W0775

W0775 does not disclose or suggest any technical matters related to the properties of Claim 1 or the composition of the present invention of Claims 2-5, nor the combination of the composition and the properties, although it discloses a ceramic plate material such as BN-Si₃N₄ as stated in the Office Action.

W0775 also does not disclose or suggest the concrete composition of ceramic plate material comprising BN-AlN-Si₃N₄, in accordance with the present invention.

W0775 does not disclose or suggest features (a), (f) and (h) of Claim 1.

Therefore, W0775 does not disclose or suggest Claim 1 or Claims 2-5.

JP468

JP468 discloses a refractory for a continuous casting facility characterized by compounding the mixture of two to four kinds of main raw materials selected from BN, Si_3N_4 , AlN and Al_2O_3 with 1 - 15 wt.% of $\text{MgO} \cdot \text{Al}_2\text{O}_3$ (spinel) (refer to the Abstract and Claim 1 of JP468).

$\text{MgO} \cdot \text{Al}_2\text{O}_3$ (spinel) has an effect to improve strength, thermal shock resistance and corrosion resistance (refer to lines 7 to 8 on column 3, "the improvement of strength and thermal shock resistance was found, and corrosion resistance, a main property, was improved (by adding 1 - 15 wt.% of $\text{MgO} \cdot \text{Al}_2\text{O}_3$ (spinel) to the mixture of main raw materials).").

As a result, the refractory of JP468 has excellent corrosion resistance (refer to the Abstract).

On the other hand, the ceramic plate materials of Claims 2 - 5 based on the basic composition of BN-AlN- Si_3N_4 does not include $\text{MgO} \cdot \text{Al}_2\text{O}_3$ (spinel) included as an indispensable composition to improve strength, thermal shock resistance and corrosion resistance in the refractory as in JP468, though the ceramic plate material of Claim 5 includes one or more of Al_2O_3 , MgO, ZrO_2 and Y_2O_3 .

That is, in terms of composition of ceramic material, the composition of JP468 is different from that of claims 2-5.

Also, JP468 does not disclose or suggest any technical matters related to features (f) and (h) embodied by Claim 1.

Therefore, JP468 does not disclose or suggest Claim 1 or Claims 2-5.

JP468 discloses a composition comprising 5 - 70 wt.% of BN, 25 - 75 wt% of Si_3N_4 and 3 - 35 wt.% of AlN as the desirable composition to include $\text{MgO} \cdot \text{Al}_2\text{O}_3$ (spinel) (refer to the Abstract and line 1 on column 3, "for example, in the case of selecting three kinds of raw materials out of the above-mentioned four raw materials, a composition comprising 5 - 70 wt.% of a born nitride (BN) raw material, 25 - 75 wt.% of a silicon nitride (Si_3N_4) raw material and 3 - 35 wt.% of an aluminum nitride (AlN) raw material is desirable.").

However, JP468 does not disclose the concrete properties of the ceramic material comprising 5 - 70 wt.% of BN, 25 - 75 wt.% of Si_3N_4 and 3 - 35 wt.% of AlN not including $\text{MgO} \cdot \text{Al}_2\text{O}_3$ (spinel) though it is estimated that the ceramic material without the spinel has good corrosion resistance.

Also, as mentioned above, JP468 does not disclose any technical matters related to the features (f) and (h) embodied in Claim 1.

Therefore, the properties of the ceramic material with the spinel of JP468 do not suggest the

properties of Claim 1 embodied by both features (f) and (h), and the embodiment of the composition and the properties.

Also, the composition of the ceramic material without the spinel does not suggest the composition of Claims 2 - 5 and the combination of the composition and the properties.

Therefore, JP468 does not disclose or suggest Claim 1 or Claims 2-5.

Combination of WO775 and JP468

As mentioned above, WO775 does not disclose or suggest the concrete composition and the properties of ceramic plate material comprising BN-AlN-Si₃N₄.

JP468 does not disclose the concrete properties of the ceramic material comprising 5 - 70 wt.% of BN, 25 - 75 wt.% of Si₃N₄ and 3 - 35 wt.% of AlN not including MgO·Al₂O₃ (spinel) as required by JP468.

Furthermore, neither of WO775 and JP468 disclose or suggest the indexes or any technical matters related to the indexes (features (f) and (h) of Claim 1) that are required by Claim 1 for the first time by the inventors of the present invention.

Therefore, even if the combination of WO775 and JP468 is assumed to be possible, the combination does not disclose or suggest Claim 1 or Claims 2 - 5.

It is therefore submitted that independent Claim 1, and Claims 2 to 5 dependent thereon, are patentable over WO 98/35775 in view of Japan No. 4-342468.

CONCLUSION

It is submitted that in view of the foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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